EWAF

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	**Bruesselbach, Hans W.; et al.**	)	Examiner:	Peace, Rhonda S.
Serial No.:	**10/759,511**	)	Art Unit:	2874
Filed:	January 15, 2004	)	Our Ref:	B-4759NP 621649-7
For:	"METHOD AND APPARATUS FOR COMBINING LASER LIGHT"	)	Date:	November 3, 2006
		)	Re:	*Appeal to the Board of Appeals*

BRIEF ON APPEAL

Mail Stop Appeal-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the Final rejection, dated May 5, 2006, for the above identified patent application. The fee set forth in 37 C.F.R. 1.17(c) for submitting this Brief was sent on October 2, 2006. The Appellants submit that the present Appeal Brief is being timely filed, since it is filed in reply to the Notice of Non-Compliant Appeal Brief issued on October 25, 2006.

REAL PARTY IN INTEREST

The present application has been assigned to HRL Laboratories, LLC of Malibu, CA.

RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences related to the present application.

STATUS OF CLAIMS

Claims 1-17 and 19-30 are pending in the present application. Claim 18 was cancelled without prejudice in response to the Office Action issued on July 25, 2005. Claims 1-17 and 19-30 are the subject of this appeal and are reproduced in the accompanying claims appendix.

SUMMARY OF CLAIMED SUBJECT MATTER

The present application is related to and claims the benefit of United States Provisional Patent Application Serial No. 60/441,026, filed on Jan. 17, 2003 and titled "Method and Apparatus for Combining Laser Light."

The subject matter of the present application also claims the benefit of United States Provisional Patent Application Serial No. 60/441,027, filed on Jan. 17, 2003 and titled "Method and Apparatus for Coherently Combining Multiple Laser Oscillators."

The subject matter of the present application may also be related to co-pending U.S. patent application Ser. No. 10/759,510 filed on January 15, 2004, which relates to method and apparatus for coherently combining multiple laser oscillators.

The present application relates generally to coupling laser light in fibers and, more particularly, to a method and apparatus for combining laser light in a fiber bundle. In the fields of optical communication and lasers, particularly high power lasers, it is desirable to provide apparatus and methods for combining multiple optical sources into a single optical output and/or to provide multiple optical outputs from a single optical source.

Independent claim 1 recites: "*A fiber optic apparatus comprising:*

a plurality of optical fibers (100, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section* (111, see for example Figs. 2A-2C and paragraph [0035], page 7, line 27 to page 8, line 5 of the specification) *having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region* (120, see for example Figs. 1, 1A and paragraph

[0033], page 7, lines 5-12 of the specification), *wherein the second end of the fibers are detached from each other* (see for example Fig. 1)

a facet (110, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *said facet being formed by cleaving or cut and polishing said tapered region in a direction perpendicular to said fiber axis".*

Independent claim 11 recites *"A method for coupling light comprising:*

providing a plurality of optical fibers (100 see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end, a second end, and a central core extending between the first and second end;*

fusing the optical fibers together along a section of each optical fiber proximate the first end to form a fused section (111, see for example paragraph [0035], page 7, line 27 to page 8, line 5 of the specification)*;*

tapering the fused section of the optical fibers such that a core diameter of each optical fiber proximate the first end is smaller than the core diameter proximate the second end, wherein tapering the fused section comprises uniformly stretching the plurality of optical fibers to provide a desired amount of optical coupling between each optical fiber; (see for example paragraphs [0036] to [0038], page 8, line 7 to page 9, line 16 of the specification)

forming a facet (110, see for example paragraph [0033], page 7, lines 5-12 of the specification) *by cleaving or cutting and polishing said fused section in a direction perpendicular to the core; and*

illuminating the facet with the light".

Independent claim 20 recites: *"An apparatus for coupling light comprising:*

a plurality of single mode optical fibers (100, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section* (111, see for example Figs. 2A-2C and paragraph [0035], page 7, line 27 to page 8, line 5 of the specification) *having a fiber axis, the fused section of the plurality of optical*

fibers being tapered to form a tapered region; (120, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification) *and*

a facet (110, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *said facet being formed by cleaving or cutting and polishing the tapered region in a direction perpendicular to said fiber axis, wherein the facet is adapted to receive a single optical input, the single optical input being distributed amongst each optical fiber in the plurality of optical fibers, wherein the optical input has a diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber* (see for example paragraph [0046], page 11, line 20 to page 12, line 7 of the specification)".

Independent claim 27 recites: "*A fiber optic apparatus comprising:*

a plurality of single mode silica (see for example paragraph [0036], page 8, line 7-25 of the specification) *optical fibers* (100, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section* (111, see for example Figs. 2A-2C and paragraph [0035], page 7, line 27 to page 8, line 5 of the specification) *having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region* (120, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification)*; and*

a facet (110, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *said facet being formed by cleaving or cut and polishing said tapered region in a direction perpendicular to said fiber axis*".

Independent claim 28 recites: "*A fiber optic apparatus comprising:*

a plurality of optical fibers (100, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section* (111, see for example Figs. 2A-2C and paragraph [0035], page 7, line 27 to page 8, line 5 of the

specification) *having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region* (120, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification); *and*

a facet (110, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *said facet being formed by cleaving or cut and polishing said tapered region in a direction perpendicular to said fiber axis;*

wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber (see for example paragraph [0037], page 8, line 27 to page 9, line 8 of the specification).

Independent claim 29 recites: "*A fiber optic apparatus comprising:*

a plurality of optical fibers (100, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section* (111, see for example Figs. 2A-2C and paragraph [0035], page 7, line 27 to page 8, line 5 of the specification) *having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region* (120, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification); *and*

a facet (110, see for example Figs. 1, 1A and paragraph [0033], page 7, lines 5-12 of the specification), *said facet being formed by cleaving or cut and polishing said tapered region;*

wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber (see for example paragraph [0037], page 8, line 27 to page 9, line 8 of the specification)".

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Issue 1: Whether claim 1 is patentable under 35 U.S.C. 102(b) over U.S. Pat. No. 4,932,747 to Russel.

Issue 2: Whether claims 20, 23 and 26 are patentable under 35 U.S.C. 103(a) over U.S. Pat. No. 5,303,373 to Harootian.

Issue 3: Whether claim 21 is patentable under 35 U.S.C. 103(a) over Harootian in view of U.S. Pat. No. 6,827,500 to Basavanhally.

Issue 4: Whether claim 22 is patentable under 35 U.S.C. 103(a) over Harootian in view of U.S. Pat. No. 5,045,100 to Smith.

Issue 5: Whether claim 24 is patentable under 35 U.S.C. 103(a) over Harootian in view of Smith and further in view of U.S. Pat. No. 6,411,762 to Anthon.

Issue 6: Whether claim 25 is patentable under 35 U.S.C. 103(a) over Harootian in view of U.S. Pat. No. 6,134,362 to Au-Yeung.

Issue 7: Whether claim 27 is patentable under 35 U.S.C. 103(a) over Russel in view of U.S. Pat. No. 6,515257 to Jain.

Issue 8: Whether claims 4, 5, 9-11, 14, 19 and 28-30 are patentable under 35 U.S.C. 103(a) over Russel in view of Au-Yeung.

Issue 9: Whether claims 2 and 13 are patentable under 35 U.S.C. 103(a)

over Russel in view of Au-Yeung and further in view of Basavanhally.

Issue 10: Whether claims 3 and 12 are patentable under 35 U.S.C. 103(a) over Russel in view of Au-Yeung and further in view of Smith.

Issue 11: Whether claims 7 and 16 are patentable under 35 U.S.C. 103(a) over Russel in view of Au-Yeung and further in view of Smith and Anthon.

Issue 12: Whether claims 6, 8, 15 and 17 are patentable under 35 U.S.C. 103(a) over Russel in view of Au-Yeung and further in view of Harootian.

ARGUMENT

Issue I: Whether claim 1 is patentable under 35 U.S.C. 102(b) over U.S. Pat. No. 4,932,747 to Russel.

Rejection of claim 1

The pending language of claim 1 was filed in response to the Office Action issued on April 1, 2005 to recite "*a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region, wherein the second end of the fibers are detached from each other*".

In the Final Office Action issued on July 25, 2005, the Examiner opined that Russel teaches a plurality of optical fibers 15, wherein the second end 15a of the fibers are detached from each other (column 4, lines 46-51, Figure 3).

Appellants respectfully disagreed, and noted that, contrary to the

Examiner's assertion, Russel teaches, for example at step 60 of Fig. 4, to closely pack the input ends (15a) of the fibers, thus teaching away from keeping the fiber ends "detached from each other" as recited in claim 1. Appellants submitted that at least in view of the above, claim 1 is patentable over Russel.

In the Office Action issued on January 10, 2006, the Examiner noted that Russel recites *"individual fibers"* and concluded that Russel shows ends that are "detachable from each other". However, the Appellants respectfully noted that teaching ends that are "detachable from each other" does not teach ends "detached from each other" as recited in claim 1, and respectfully submitted that the Examiner had hereby acknowledged that claim 1 is not anticipated by Russel.

Besides, the Appellants submitted that the Examiner has failed to show why one skilled in the art would have been motivated to detach the allegedly detachable input ends of Russel. The Appellants noted that Russel relates (see col. 2, lines 44-51) to an apparatus "for homogenizing the intensity profile of an excimer laser" wherein "an excimer laser beam is collected by the input ends of a closely arranged optical fiber bundle array", which allows homogenizing the output of a laser with "reduced losses" (col. 2, lines 58-60).

The Appellants noted that one skilled in the art readily understands from the reference that separating the input ends of the fibers instead of packing them would increase the losses instead of reducing them, thus adversely affecting the operation of the apparatus of Russel. The Appellants submitted that actually one skilled in the art is taught away from detaching the individual input ends of Russel from each other, since this would prevent the Apparatus from operating as disclosed in Russel. So even assuming that the ends are "detachable", Russel teaches away from using ends "detached from each other" as claimed. Accordingly, the Appellants respectfully submitted that claim 1 is patentable over Russel.

In the Final Office Action issued on May 5, 2006 the Examiner kept rejecting independent claim 1 as being anticipated by Russel. The Examiner acknowledged that Russel teaches input ends 15a that are closely packed, but

opined that Russel nevertheless teaches ends "detached from each others". The Rationale of the Examiner is that *"while these individual fibers are closely packed within a bundle, the fact that they are unfused, as opposed to the first end (15", fig. 5 of Russel) which are fused, makes them detached from one another, as required by claim 1. The second ends of Russel are detached from one another, as they are separated into individual fibers. Detached fibers do not require them to be "free floating", it simply requires the fibers to be separate from one another, which the fiber ends of Russel are; therefore fibers within a packed array can still be considered "detached" if the fibers within the array are capable of transmitting their own signal without the aid of the other fibers, or in other words, are unfused"*. In the Response to Arguments, the Examiner further opined that *"fibers within a packed array can still be considered 'detached' if the fibers within the array are capable of transmitting their own signal without the aid of other fibers"*.

The Examiner repeatedly opined that Russel shows fibers not fused together and therefore detached from each other. Appellants respectfully disagree. It is basic English knowledge that known synonyms of "to attach" are "to bind" or "to join". Appellants acknowledge that fibers fused together are necessarily bound or joined or attached together.

However, the logic reciprocal is not true. Individual fibers can be bound or joined or attached together in a close bundle even if they are not fused together. Russel precisely relates to fibers not fused together but bound or joined or attached together in a close bundle. One skilled in the art readily understands that if the non-fused-together fiber ends of Russel were not bound or joined or attached together, they would not stay *"closely packed together"* as recited in Russel.

Appellants respectfully submit that the Examiner has failed to show that individual fibers not fused together are necessarily "not bound" or "not joined" or "detached". The Examiner has also failed to show why the fibers of Russel would stay *"closely packed together"* if they were not bound or joined or attached together.

Accordingly, Appellants respectfully submit that the Examiner has failed to show that Russel discloses or suggests an apparatus as recited in claim 1, and

in particular comprising a plurality of optical fibers having a first end and a second end, *"wherein the second end of the fibers are detached from each other"*.

Appellants further respectfully submit that it follows from the above reasoning that by teaching to closely pack the input ends of the fibers Russel actually teaches away from keeping the fiber ends "detached from each other" as recited in claim 1.

Appellants therefore respectfully submit that claim 1 is patentable over Russel, and that the Examiner's rejection should be properly overturned.

Issue 2: Whether claims 20, 23 and 26 are patentable under 35 U.S.C. 103(a) over U.S. Pat. No. 5,303,373 to Harootian.

Rejection of claim 20

The pending language of claim 20 was filed in response to the Office Action issued on July 25, 2005 to recite *"a plurality of single mode optical fibers"*. The language of claim 2o was also clarified to recite *"a facet, said facet being formed by cleaving or cutting and polishing the tapered region in a direction perpendicular to said fiber axis, wherein the facet is adapted to receive a single optical input, the single optical input being distributed amongst each optical fiber in the plurality of optical fibers"*.

In the Office Action issued on January 10, 2006, The Examiner opined that Harootian discloses all the features of claim 20 except the use of single mode fibers, and opined that Harootian places no limitations upon the kinds of fibers that may be used with its device (col. 4, lines 8-10 of Harootian recite that there is *"no criticality to the overall dimensions of the [...] individual optical fibers used"*). The rationale of the Examiner is that "one may draw the conclusion that all fibers would be suitable for such a device, including single mode fibers".

However the Appellants noted that, contrary to the assertion of the

Examiner, the above excerpt of Harootian actually teaches one skilled in the art to use multimode fibers, since multimode fibers are fibers for which the overall dimensions are not critical, whereas dimensions are critical in single mode fibers. Appellants noted that accordingly, the above excerpt shows that Harootian actually teaches away from using *"single mode"* fibers as recited in claim 20. At least for the above reason, the Appellants respectfully submitted that claim 20 is patentable over Harootian.

Further, Appellants noted that Harootian relates to a device for transferring pixel information, wherein it would be highly undesirable to couple the information of neighboring pixels since this would blur the output information of the device. Appellants noted that the device of Harootian uses glass multimode fibers, whereby tapering the fibers as taught does not create significant coupling between the fibers, thus avoiding coupling between the pixels. Appellants respectfully submitted that, as evidenced by the Hill reference cited by the Examiner, one skilled in the art would have readily understood that using single mode fibers in the device of Harootian would have introduced some coupling between neighboring pixels, thus adversely affecting the operation of the device. Appellants therefore respectfully submitted that accordingly, one skilled in the art would also have been taught away from using single mode fiber in the device of Harootian by fear of generating undesirable coupling between the pixels (as taught by Hill), which would have blurred the output image of the device. For the above reason also, the Appellants respectfully submitted that claim 20, which recites using *"single mode"* fibers, is patentable over Harootian.

In the Final Office Action issued on May 5, 2006, the Examiner kept rejecting independent claim 20 as being obvious over Harootian. The Examiner acknowledged that Harootian does not disclose the use of single mode fibers, but opined that "one skilled in the art would be motivated to use such fibers when it is desired to transmit signals in a single mode only". The Appellants respectfully disagree and note that Harootian relates to an *"anamorphic fused fiber optic bundle continuously tapered from the dimensions of one end to the dimensions of its other end and usable for coupling imaging devices having active area format of different shapes,*

dimensions, aspect ratios, etc... while maintaining the same number of active pixels (fiber elements) at each end of the bundle" (col. 1, lines 4-10).

The Appellants note that the Examiner implied that it may be desired to transmit pixel information in a single mode only. The Appellants respectfully disagree and note that it is common knowledge that single mode is used for retaining the fidelity of light pulses transmitted over long distances, thus allowing transmissions up to 10 Gigabit/second over distances such a 60 km (see for example: http://en.wikipedia.org/wiki/Single-mode_optical_fiber). The Appellants note that Harootian relates to devices having a typical length of 1-12 cm (col. 4, lines 13-15) for transmitting pixels of an imaging device for showing images to the human eye, wherein it is common knowledge that imaging devices display pixels at frequencies related to the eye persistence, and usually no greater than 100Hz (see for example http://en.wikipedia.org/wiki/Persistence_of_vision).

The Appellants respectfully remind the Examiner that section 2143.01 of the MPEP provides that "**Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art**".

Appellants respectfully submit that the Examiner has failed to show that "there is some teaching, suggestion, or motivation", "either in the references themselves or in the knowledge generally available to one of ordinary skill in the art", to transmit the pixel signals of Harootian, typically changing with a frequency no more than 100hz and transmitted over some centimeters, at frequencies up to 10 Gigabit/second and over a distance such as 60 km, which would teach, suggest or motivate that "it is desired to transmit signals in a single mode only", as opined by the Examiner.

The Examiner further opined that "*In response to applicant's arguments that Harootian teaches away from the use of single mode fibers [...] the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly*

suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). While coupling between cores of single mode fibers which are fused and tapered within a bundle may occur, the coupling ratio between cores is dependent upon the length and diameter of the waist of the taper [...]. In this case, although Harootian does not encourage coupling between the cores of the fibers within the bundle, this does not teach away from the use of single mode fibers, as the coupling ratio can be controlled in the tapering process".

Appellants note that the Examiner opined that single mode fibers could be used in Harootian without coupling the fibers because *"the coupling ratio between cores is dependent upon the length and diameter of the waist of the taper"*. The Examiner implied that the diameter and waist of the tapper would be chosen to have no coupling, as required by Harootian. Appellants respectfully disagree and note that Harootian relates to tapered fused fiber optic bundle for coupling a first imaging device having first shape, dimension and aspect ratio to a second imaging device having second shape, dimension and aspect ratio, whereby the tapering of the fiber optic bundle depends strictly on the first and second shapes, dimensions and aspect ratios. Appellants respectfully submit that the Examiner has failed to show that there is any suggestion in the art that the process of tapering single mode fiber can be controlled so as to obtain at the same time a desired diameter and waist of the taper AND a desired (null) coupling of the fibers.

Accordingly, Appellants respectfully submit that the Examiner has failed to show that the combined teachings of the references would have suggested to those of ordinary skill in the art that it would be possible, using single mode fibers in the device of Harootian, to taper the fibers to obtain the desired imaging device shapes, dimensions and aspect ratio while at the same time avoiding any coupling between the fibers.

Besides, Appellants note that the amount of light transmitted by a single mode fiber is much smaller than the amount of light transmitted by a multimode fiber having a same outer diameter, whereby using single mode fibers in Harootian would severely restrict the amount of light transmitted for each pixel,

and would thus render the device of Harootian unsatisfactory for its intended purpose of coupling imaging devices. Section 2143.01 of the MPEP provides that "**If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification**".

In summary, Appellants note that the Examiner has failed to show that there is any suggestion in Harootian or in the art to use single-mode fibers. Appellants further note that using single mode fibers in Harootian would have made the device of Harootian unsatisfactory for its intended purpose of coupling imaging device. Appellants therefore respectfully submit that the Examiner has failed to show that it would have been obvious to modify the teachings of Harootian to obtain an apparatus as recited in claim 20, and in particular comprising "*a plurality of single mode optical fibers*", and submit that claim 20 is patentable over Harootian, whereby the Examiner's rejection should be properly overturned.

<u>Rejection of claims 23 and 26</u>

Claims 23 and 26 depend on claim 20. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine,* 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claims 23 and 26 are also allowable. Further, Appellants will now show that the rationale for rejecting the following claims based upon their recited features is also not proper.

Claim 23 recites "*The apparatus of claim 20, wherein each optical fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region*". The Examiner opined that Harootian shows the device of claim 20 wherein the core diameter of each optical fiber in the tapered region is smaller than the core diameter of each optical fiber in the non-tapered region (column 2, lines 27-37).

Appellants respectfully disagree and note that column 2, lines 27-37 of Harootian recite *"Thus, this invention relates to an anamorphic, tapered fused fiber optic bundle having a longitudinal axis Z and two ends each having surfaces in a plane (X axis/Y axis) perpendicular to said Z axis, a first end having cross-sectional dimensions X and Y and a second end having dimensions X' and Y', at least X' being smaller than X, and the ratio X'/X being different from the ratio Y'/Y, wherein the X axis dimension of said fiber continuously varies along said Z axis from the value X in said first end to the value X' in the second end"*. Appellants note that the above excerpt relates to the overall dimensions of the fiber optic bundle, and does not relate to the core diameter of the fibers of the bundle. Accordingly, Appellants respectfully submit that the Examiner has failed to show that Harootian discloses or suggests an apparatus as recited in claim 23, and in particular *"wherein each optical fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region"*. Appellants submit that for this reason also, claim 23 is patentable over Harootian, whereby the Examiner's rejection should be properly overturned.

Claim 26 recites *"The apparatus of claim 20, wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers"*. The Examiner opined that "Harootian teaches the device of claim 20 wherein at least one optical fiber has a different core size from at least one other optical fiber (column 4 lines 8-16)".

Appellants respectfully disagree and note that column 4, lines 8-16 of Harootian recite *"There is also no criticality to the overall dimensions of the fiber bundles utilized or of the individual optical fibers used. These will be chosen fully conventionally. Typically, individual fiber outer diameters are in the range of 3-50 μm and overall fiber bundle sizes are in the range of 2-100 mm. Typical optical fiber lengths used to couple imaging devices are normally in the range of 1-12 cm, again, the particular length involved not being critical"*. Appellants note that the above excerpt teaches that the individual optical fibers used may have outer diameters in a given range, but does not teach that they may each have a different size. Besides, Appellants note that fibers may well have different outer diameters and identical

core diameters. Accordingly, the above excerpt does not disclose or suggest the features recited in claim 26.

Further, Appellants note that using in Harootian fibers having different core sizes would mean conveying a different amount of light for different pixels, whereby the coupling ratio of the device would differ from one pixel to another. Appellants respectfully submit that such device is neither taught nor suggested in Harootian, would couple non-uniformly the two imaging devices of Harootian, and would thus not operate satisfactorily. In view of the above, Appellants respectfully submit that the Examiner has failed to show that Harootian discloses or suggests an apparatus as recited in claim 26, and in particular *"wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers"*. Appellants therefore submit that for this reason also, claim 26 is patentable over Harootian, whereby the Examiner's rejection should be properly overturned.

Issue 3: Whether claim 21 is patentable under 35 U.S.C. 103(a) over Harootian in view of U.S. Pat. No. 6,827,500 to Basavanhally.

Rejection of claim 21

Claim 21 recites *"the apparatus of claim 20, wherein the plurality of optical fibers are arranged in an array, the array being selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays"*.

In the Office Action issued on January 10, 2006, the Examiner opined that the use of the teachings of Basavanhally with the device of Harootian would have been obvious, as the hexagonal array described by Basavanhally minimizes unused space within the optical fiber bundle.

Appellants respectfully disagreed and noted for example that figures 2(a) and 2(b) of Harootian show non-hexagonal arrays where no space is lost within the optical fiber bundle. Appellants respectfully submitted that the Examiner had failed to show how an hexagonal array could minimize the unused space in Harootian, in particular in view of the fact that there seems to be no such unused space in Harootian. Besides, Appellants noted that Harootian relates to an *"anamorphic fused fiber bundle which is tapered from the cross-sectional geometry at one end to a different cross-sectional geometry at the other end and which is useful to couple imaging devices"* (Col. 2, lines 22-25). Appellants respectfully submitted that the Examiner had failed to show that one skilled in the art would have been motivated to give the apparatus of Harootian the shape disclosed in Basavanhally to modify an imaging device to have an hexagonal input or output. Why do that? What problem exists in Harootian that a person of ordinary skill is motivated to overcome with the teachings of Basavanhally? Why is "unused space" a problem in Harootian? And even if that were a problem, why use a hexagonal shape when imaging device having such a shape do not seem to exist? Accordingly, Appellants respectfully submitted that the combination of Harootian and Basavanhally is improper, and that at least in view of its dependency, claim 21 is also patentable over Harootian in view of Basavanhally.

In the Office Action issued on May 5, 2006, in the response to arguments, the Examiner opined that "figures 2(a) and 2(b) of Harootian show a view of the fiber before (Fig 2a) and after (Fig 2b) the fiber bundle is compressed (Harootian; col. 4, lines 34-47). Therefore, in Fig 2a, there is certainly unused space, as the bundle can experience further compression (shown in Fig 2b). However, even in Figure 2(b) after compression, one can see that space is still being unused, as the dark areas represent space between the optical fiber cores (portion which will output a light signal). Since Harootian compresses the fiber bundle, it can be clearly seen that Harootian wishes to minimize unused space in the fiber bundle. Therefore Harootian does suggest minimization of unused space is desirable for the device". Appellants respectfully disagree with the Examiner. The Examiner's

rationale is based on the assertion that in Figs. 2a and 2b of Harootian, "the dark areas represent space between the optical fiber cores". The Appellants respectfully disagree. Figs. 2a and 2b of Harootian are reproduced hereafter.

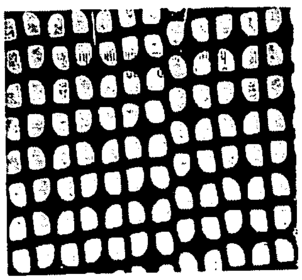


FIG. 2(a)

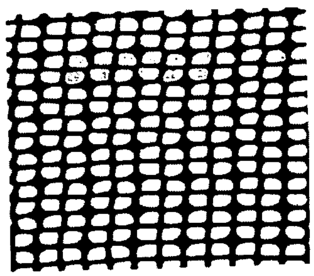


FIG. 2(b)

Appellants respectfully submit that the Examiner has overlooked the fact that the fibers of Harootian have claddings (see for example column 9, lines 18-20), and has failed to explain where the claddings of the fiber cores would be, if the dark areas of Figs. 2a and 2b were "space" between the light-outputting optical fiber cores, as opined by the Examiner. The Examiner seems to assume that the cladding will somehow disappear. There is no factual basis for that assumption.

Appellants further note that Harootian explicitly recites that voids (unused space) are totally eliminated from the finished device (column 5, lines 30-32, that "*the temperature is raised, e.g., to 688.degree. C, for an additional 45 to 60 minutes under pressure to insure total elimination of all voids*"). There is thus no unused space in the device of Harootian. One of ordinary skill in the art would have found no motivation in Harootian to look for a way to minimize something that does not exist, such as unused space, contrary to the opinion of the Examiner.

Besides, Basavanhally relates to a precise fiber array formed by employing a precise array of ferrules arranged with a hexagonal packing structure, the ends of optical fibers being bonded into the ferrules (column 2, lines 12-15), where there is a lot of unused space between the cylindrical ferrules (see for example Fig. 8 of Basavanhally below) and even more unused space between the fiber ends bonded in the ferrules (the fiber ends are separated by a distance

substantially equal to one ferrule diameter minus one fiber diameter, see Fig. 9 of Basavanhally hereafter).

FIG. 8

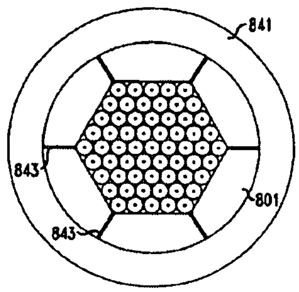
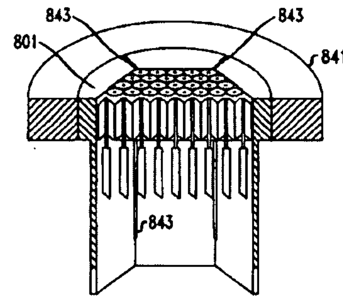


FIG. 9



Accordingly, Appellants respectfully submit that even if Harootian's device has had voids between the fibers, and if one skilled in the art had looked for a way to minimize the voids between the fibers, one skilled in the art would not have been motivated to look for a solution in Basavanhally, which has a lot of voids between the fibers. Appellants respectfully submit that it seems from the above that the Examiner has used the language of claim 21 as a roadmap to combine Harootian and Basavanhally, whereas one skilled in the art would actually have found no motivation to combine these references.

At least in view of the above, Appellants respectfully submit that the Examiner has failed to show that one skilled in the art would have been motivated to combine the teachings of Harootian and Basavanhally to obtain the features recited in claim 21, whereby the combination of Harootian and Basavanhally is improper and claim 21 is patentable over Harootian in view of Basavanhally, and whereby the Examiner's rejection should be properly overturned.

Issue 4: Whether claim 22 is patentable under 35 U.S.C. 103(a) over Harootian in view of U.S. Pat. No. 5,045,100 to Smith.

<u>Rejection of claim 22</u>

Claim 22 recites *"the apparatus of claim 20, wherein the plurality of optical fibers are provided in a glass matrix"*.

In the Office Action issued on May 5, 2006, the Examiner acknowledged that Harootian does not disclose the use of a glass matrix to contain the fibers. However, the Examiner opined that Smith discloses the use of a glass matrix to contain the fibers, and opined that to one of ordinary skill in the art, it would have been obvious to couple the teachings of Haroorian and Smith for the purpose of continuity, under the rationale that "the use of a glass matrix is beneficial as it provides material continuity between all elements of the optical fiber bundle, ensuring the optical fibers will behave in an appropriate manner".

Appellants respectfully disagree and note that, as seen above in relation with claim 21, voids are totally eliminated from the device of Harootian (column 5, lines 30-32), and thus there is no space where a glass matrix could be introduced for "providing continuity" between the elements (fibers) of Harootian. Accordingly, not only has the Examiner failed to show that there was any motivation to combine the teachings of Harootian and Smith, the Examiner has also failed to show that there was any possibility to actually combine such teachings. Appellants respectfully submit that it seems from the above that the Examiner has used the language of claim 22 as a roadmap to combine Harootian and Smith, whereas one skilled in the art would actually have found no motivation to combine such references. The Examiner is trying to solve a non-existent problem by combining these references.

At least in view of the above, Appellants respectfully submit that the Examiner has failed to show that one skilled in the art would have been motivated or able to combine the teachings of Harootian and Smith to obtain the features recited in claim 22, whereby the combination of Harootian and Smith is improper and claim 22 is patentable over Harootian in view of Smith, and whereby the Examiner's rejection should be properly overturned.

Issue 5: Whether claim 24 is patentable under 35 U.S.C. 103(a) over Harootian in view of Smith and further in view of U.S. Pat. No. 6,411,762 to Anthon.

Claim 24 recites *"the apparatus of claim 22, wherein the glass matrix is comprised of fluorosilicate"*.

In the Office Action issued on May 5, 2006, the Examiner acknowledged that Harootian or Smith do not disclose the use of fluorosilicate in a glass matrix to restrain fibers. However, the Examiner opined that Anthon discloses the use of a fluorosilicate glass matrix in the formation of optical fiber bundles (column 13, lines 1-16), and opined that fluorosilicate minimizes any light that may be passed from one optical fiber within the bundle to another, whereby it would have been obvious to one skilled in the art to use fluorosilicate as the specific glass matrix material.

Appellants respectfully disagree and note that column 13, lines 1-16 of Anthon recite *"FIGS. 4A-4D illustrate a similar fabrication technique that can be used to introduce irregularities into the shape of a preform 65. According to this technique, a standard multimode preform 65, comprising, e.g., **an** undoped fused silica inner region 68 and a fluorine doped outer layer 70, is obtained. An ultrasonic drill is used to drill equally spaced holes 72-84 immediately inside the boundary between inner region 68 and layer 70. By way of example, eight holes, each having a diameter of about 10% of the preform diameter, can be drilled on circle at about 60% of the preform diameter, leaving a small amount of silica material between the holes and the boundary between region 68 and layer 70 to protect the fluorosilicate glass of the outer layer 70. Preferably, the distance between each hole and the boundary between cladding layers 68, 70 is approximately 1-2% of the preform diameter"*. Appellants respectfully submit that the above excerpt relates to the manufacturing of one particular fiber, not of an optical fiber bundle, contrary to the assertion of the Examiner. Accordingly, the Examiner has failed to show that there would have been any motivation for one skilled in the art to use the teachings of Anthon in the formation of optical fiber

bundles.

Besides, Appellants have noted in relation with claim 24 above that the device of Harootian has no space where a glass matrix could be introduced. Appellants respectfully submit that the Examiner has failed to show that there exist any motivation to combine the teachings of Harootian and Smith or Anthon, and that the Examiner has also failed to show that there was any possibility to actually combine such teachings.

At least in view of the above, Appellants respectfully submit that the Examiner has failed to show that one skilled in the art would have been motivated or able to combine the teachings of Harootian, Smith and Anthon to obtain the features recited in claim 24, whereby the combination of Harootian, Smith and Anthon is improper and claim 24 is patentable over Harootian in view of Smith and Anthon, and whereby the Examiner's rejection should be properly overturned.

Issue 6: Whether claim 25 is patentable under 35 U.S.C. 103(a) over Harootian in view of U.S. Pat. No. 6,134,362 to Au-Yeung.

Rejection of claim 25

Claim 25 recites *"the apparatus of claim 20, where the plurality of optical fibers in the fused section are uniformly stretched to provide a desired amount of optical coupling between each optical fiber"*.

In response to the Office Action issued on January 10, 2006, Appellants noted that Au-Yeung relates to optical fiber couplers having a melted zone that *"provides strong field coupling between the optical fibers"* (col. 2, lines 43-44). Harootian relates to an apparatus using multimode fibers for transferring pixel information from one imaging apparatus to another, wherein it is highly undesirable to introduce noise in the transferred pixel information.

The Appellants respectfully submitted that one skilled in the art would have lacked motivation to modify the apparatus of Harootian to have fibers

coupled as in Au-Yeung, because such coupling between the fibers would have impaired the operation of the apparatus by introducing undesirable noise in the pixel information transferred by the apparatus. Appellants respectfully submitted that the combination of Harootian and Au-Yeung is improper, and that claim 20 is patentable over Harootian in view of Au-Yeung. Appellants further submitted that at least in view of its dependency on claim 20, claim 25 is patentable over Harootian in view of Au-Yeung.

Besides, the Appellants noted that Harootian relates (see for example col. 2, lines 11-20) to an apparatus *"where the shape at one end is configured to fit precisely the corresponding cross-sectional shape of an imaging device and the shape at the other end is configured to fit precisely the cross-sectional surface area of a second imaging device to be coupled to the first"*. The Appellants noted that Au-Yeung teaches (col. 1, lines 27-28) that heated fibers can be stretched until a desired coupling ratio is achieved. However, the Appellants noted that Au-Yeung does not teach that it is possible to achieve simultaneously a desired optical coupling and a required size and shape. Accordingly, the Appellants submitted that, even if one skilled in the art had decided, for a non-specified reason, to combine the teachings of Harootian and Au-Yeung to make a precisely dimensioned device such as recited by Harootian, having the coupled fibers of Au-Yeung, the coupling between the fibers would have been given by the precise size and shape of the apparatus. Appellants note that such a <u>given</u> coupling would not have read on *"a <u>desired</u> amount of optical coupling between each optical fiber"* as recited in claim 25. In view of the above also, the Appellants submitted that claim 25 is patentable over Harootian in view of Au-Yeung.

In the Office Action issued on May 5, 2006, the Examiner acknowledged that Harootian does not disclose uniformly stretching the bundle of fibers to obtain the desired amount of coupling between the cores of the fibers within the bundle, but opined that Au-Yeung discloses that various amounts of stretching during the fusing process lead to various amounts of coupling between the cores of the fibers within the bundle, whereby it would have been obvious to combine Harootian and Au-Yeung. The rationale of the Examiner is that this would allow

the device of Harootian to be modified to achieve the desired amount of coupling by uniformly stretching the fused portion of the bundle by an amount denoted by Au-Yeung, thereby allowing for greater specialization of the bundle, and more accurate formation of the bundle's coupling ratio. In the response to arguments, the Examiner further opined that the Appellants have "stated that Harootian teaches to minimize coupling between fibers of the bundle", whereby "clearly Harootian is concerned with the amount of coupling between fibers of the bundle". Appellants respectfully disagree with the conclusion reached by the Examiner.

As to Appellants stating that "Harootian teaches to minimize coupling between fibers of the bundle", Appellants could not find where Appellants made such statement. Harootian relates to a device for transferring pixel information using glass multimode fibers, where tapering such fibers does not create significant coupling between the fibers, thus avoiding coupling between the pixels. Coupling the fibers corresponding to neighboring pixels would blur the output information of the device, which would be highly undesirable and would make the device of Harootian less desirable for its intended purpose of transferring pixel information.

As to Harootian being "concerned with the amount of coupling between fibers of the bundle", Appellants respectfully submit that the reasoning of the Examiner is flawed: noting that there is no coupling between the fibers of Harootian and that coupling would be undesirable is not sufficient to conclude that Harootian is "concerned with the amount of coupling between fibers of the bundle". To clarify the matter, as an example, Harootian does not disclose that radioactivity is produced when the device of Harootian operates; it would certainly be undesirable if radioactivity were produced, but this is not enough to conclude that Harootian is "concerned with" reducing the radioactivity produced by the operation of the device.

Assuming, *arguendo*, that Harootian were "concerned with" the amount of coupling between fibers of the bundle, and in particular with having no coupling between the fibers, Appellants note that Au-Yeung teaches that tapering together two or more optical fibers having narrow cores such as single-mode fibers leads

to a coupling between the fiber cores, and that Hill (U.S. 5,150,439, cited by the Examiner as being part of the knowledge of the skilled person) teaches that tapering together two single-mode fibers leads to a coupling between the fiber cores. The Examiner noted that the test for obviouness is what the combined teachings of the references would have suggested to those of ordinary skill in the art. In view of the above, Appellants respectfully submit that one skilled in the art having the knowledge of Hill and Au-Yeung would have understood that the best way to prevent coupling between the fibers in a device such as in Harootian is simply to not use single-mode fibers in such a device. Accordingly, even if one skilled in the art had considered combining the teachings of Harootian and Au-Yeung, these references would actually have suggested not using single-mode fibers in the device of Harootian, whereby teaching away from an apparatus as recited in claim 20, and in particular comprising *"a plurality of single mode optical fibers"*. At least in view of the above, claim 20 is patentable over Harootian in view of Au-Yeung, and at least in view of its dependency, claim 25 is patentable over Harootian in view of Au-Yeung.

Besides, the Examiner is respectfully reminded that section 2143.01 of the MPEP provides that "**If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification**". The Appellants note that Au-Yeung teaches (col. 1, lines 27-28) that heated fibers can be stretched until a desired coupling ratio is achieved, but does not teach that it is possible to achieve simultaneously a desired optical coupling and a required size and shape. On the other hand Harootian relates (see for example col. 2, lines 11-20) to an apparatus *"where the shape at one end is configured to fit precisely the corresponding cross-sectional shape of an imaging device and the shape at the other end is configured to fit precisely the cross-sectional surface area of a second imaging device to be coupled to the first"*, whereby the device of Harootian would be unsatisfactory for its intended purpose if its dimensions were not the precisely desired ones.

Appellants respectfully submit that, even if one skilled in the art had decided, for a non-specified reason, to combine the teachings of Harootian and Au-Yeung to make a device such as recited by Harootian, either:

-the resulting device would have had a desired amount of optical coupling between the fibers, but would not have had the precisely desired dimensions, and would have been unsatisfactory for the intended purpose of Harootian's device (whereby combining Harootian and Au-Yeung is improper); or

-the resulting device would have had the desired dimensions, but would not have had the desired optical coupling between the fibers, and would thus not have read on the features of claim 25.

At least in view of the above, Appellants respectfully submit that claim 25 is patentable over Harootian in view of Au-Yeung, whereby the Examiner's rejection should be properly overturned.

Issue 7: Whether claim 27 is patentable under 35 U.S.C. 103(a) over Russel in view of U.S. Pat. No. 6,515257 to Jain.

Rejection of claim 27

Claim 27 recites "*A fiber optic apparatus comprising: a plurality of single mode silica optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and a facet, said facet being formed by cleaving or cut and polishing said tapered region in a direction perpendicular to said fiber axis*".

In the office Action issued on January 10, 2006, the Examiner opined that Jain discloses single mode fibers (column 9, lines 21-24) and opined that it would have been obvious to one of ordinary skill to combine the teachings of Russel and Jain, as the use of these fibers allow the device to be applicable to areas where it is desirable to transmit only a single mode.

Appellants respectfully disagreed and noted that Russel relates to an apparatus provided to homogenize the intensity profile of the beam emitted by

an excimer laser with reduced losses (col. 2, lines 58-59). Russel teaches that an excimer laser is of multimode nature (col. 5, lines 16-17). Appellants submitted that modifying the apparatus of Russel "to transmit only a single mode" of a laser of multimode nature would transmit less power and go against the object of Russel to reduce losses.

Besides, the Appellants noted that Jain teaches, column 9, lines 21-26, using very thin "*UV-grade fused silica fibers with 5 to 10 micron diameter cores and several micron thick cladding*" to form an "*array with a pitch of 6 to 30 microns*". The Appellants noted that the fibers disclosed by Jain have a cladding diameter to core diameter ratio from 1.2:1 (5 micron diameter core with array pitch of 6 microns) to 6:1 (5 micron diameter core with array pitch of 30 microns). The Appellants further noted that Russel explicitly teaches (col. 4, lines 10-13) that "*each fiber core radius should be large compared to the cladding thickness for optimal packing efficiency (a cladding diameter to core diameter ratio of 1.2:1 is typical)*". Appellants accordingly submitted that one skilled in the art would readily understand that modifying the apparatus of Russel to use the fibers of Jain would at best offer no advantage with regard to the cladding to core diameter ratio recited in Russel (1.2:1), and would most likely lead to a detrimental increase of this ratio (up to 6:1), which would not provide an "*optimal packing efficiency*" as described by Russel.

The Appellants further noted that Russel relates to an apparatus having an input of typically 12 millimeter by 25 millimeter (col. 4, lines 25-27) using fibers having a cladding diameter of 2400 microns (col. 5, lines 65-67), thus roughly corresponding to an apparatus comprised of 125 fibers. The Appellants noted that using the fibers of Jain having the best cladding to core diameter ratio of 1.2:1, i.e. having a cladding diameter of 6 microns, would mean manufacturing an apparatus comprised of more than 8.3 million fibers. Appellants also noted that fibers of 6 microns in diameter are likely to be very fragile and extremely delicate to handle. The Appellants submitted that one skilled in the art readily understands that multiplying by more than sixty-six thousand the number of fibers to be handled to manufacture an apparatus, while at the same time using fibers far more delicate to handle, would probably increase the costs of

manufacturing of the apparatus. Why do that? To get less energy at its output? In view of the above, the Appellants respectfully submitted that one skilled in the art would have lacked motivation for using the fibers of Jain in the apparatus of Russel because doing so would at least have meant reducing the power transmitted by the apparatus while not improving the cladding to core diameter ratio, and would even have been taught away from using the fibers of Jain in the apparatus of Russel because of the tremendous increase of the costs of manufacturing of the apparatus –without technical improvement of the apparatus- that this would have meant. Appellants therefore respectfully submitted that the combination of Russel and Jain is not proper, and that claim 27 is patentable over Russel and Jain.

In the Office Action issued on May 5, 2006, the Examiner noted that the goal of Russel is to homogenize the intensity profile of an excimer laser, opined that "the common meaning of homogenization in the optical arts is the manipulation of several signals so that they are the same in their optical properties", and concluded that "therefore, the use of single mode fibers would homogenize the output of an excimer laser, as it would restrict propagation of the signal to a single mode".

Appellants respectfully disagree and note that, as noted by the Examiner, the goal of Russel is to homogenize the <u>intensity profile</u> of an excimer laser, wherein such intensity profile is shown in Fig. 1 and relates to the spatial intensity distribution of the output beam of the laser. Fig. 1 of Russel is reproduced hereafter.

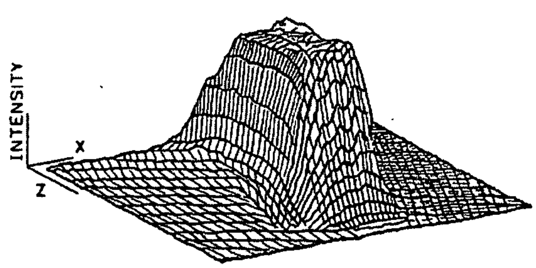


FIG. 1

Appellants note that the Examiner has failed to show that restricting

propagation of the output beam of the laser to a single mode would have any effect on homogenizing the spatial intensity distribution of the output beam of the laser.

The Examiner further opined that "construction of the device of Russel with single mode fibers allows the device to be applicable in situations where it had not previously been applicable, such as where a lower power excimer laser is required". Appellants respectfully disagree with the Examiner, and note that Russel explicitly discloses (for example column 1, line 54 to column 2, line 25) prior art systems bringing the intensity profile into a more spatially uniform distribution and coming up with energy losses of 78% or 42%. Appellants note that the prior art mentioned in Russel was related to situations where low power was collected from the excimer laser, and that Russel was precisely designed to depart from such situations. It makes no sense to modify Russel to fall back to collecting low power from the excimer laser, contrary to the assertion of the Examiner.

Besides, the Examiner is respectfully reminded that section 2143.01 of the MPEP provides that "**If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification**". The Appellants note that one object of Russel is "to provide an optical homogenization having reduced losses". The Appellants note that modifying the apparatus of Russel by replacing the multimode fibers by the single-mode fibers of Jain would reduce severely the power transmitted by the apparatus and go against the object of Russel to reduce losses, thus making the apparatus of Russel unsatisfactory for its intended purpose. Appellants therefore respectfully submit that the combination of Russel and Jain is improper.

Appellants respectfully submit that it seems from the above that the Examiner has used the language of claim 27 as a roadmap to combine Russel and Jain, whereas one skilled in the art would actually have found no motivation to combine these references.

At least in view of the above, Appellants respectfully submit that claim 27 is patentable over Russel in view of Jain, whereby the Examiner's rejection should be properly overturned.

Issue 8: Whether claims 4, 5, 9-11, 14, 19 and 28-30 are patentable under 35 U.S.C. 103(a) over Russel in view of Au-Yeung.

Rejection of claim 28

Claim 28 recites *"A fiber optic apparatus comprising: a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and a facet, said facet being formed by cleaving or cut and polishing said tapered region in a direction perpendicular to said fiber axis; wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber"*.

In the Office Action issued on January 10, 2006, the Examiner acknowledged that Russel does not disclose that the stretching will lead to a desired amount of coupling between the cores of the respective fibers within the bundle, but noted that Au-Yeung discloses a tapered fiber bundle that is fused and acts as a coupler, and opined that "it would have been obvious to one of ordinary skill in the art to combine the teachings of Russel and Au-Yeung, as it would allow the design process of Russel to be modified to achieve the desired amount of coupling by stretching the fused portion of the bundle by an amount denoted by Au-Yeung et al, thereby allowing for greater specialization of the bundle, and more accurate formation of the bundle's coupling ratio".

In response, the Appellants noted the Examiner kept opining that Russel discloses that the bundle is <u>stretched</u> during the tapering process. The Appellants

noted that in page 10 of the response to the action issued on July 25, 2005, the Appellants had submitted that Russel does not mention stretching optical fibers, and had respectfully requested the Examiner to point out where Russel discloses or suggests that stretching occurs. The Appellants noted that the Examiner had failed to show where Russel discloses or suggests that stretching occurs.

As to the obviousness to modify the device of Russel to achieve the desired amount of coupling by stretching the fused portion of the bundle by an amount denoted by Au-Yeung, thereby allowing for greater specialization of the bundle, and more accurate formation of the bundle's coupling ratio, the Appellants respectfully disagreed and noted that Au-Yeung shows (figures 5 and 7) fibers having a cladding to core diameter ratio visibly larger than the ratio of 1.2:1 taught by Russel. Appellants noted that Russel explicitly teaches away from having a large cladding to core ratio, to "prevent transmission losses resulting from scattering into the bundle cladding". Accordingly, Appellants respectfully submitted that one skilled in the art would have lacked motivation to use the fibers of Au-Yeung in Russel because this would have increased the cladding to core diameter ratio, thus increasing the power losses in the apparatus of Russel, and impairing its performance. Appellants further noted that, by teaching a typical cladding to core ratio of 1.2:1, Russel also implicitly teaches away from using a small cladding to core ratio, thus teaching away in particular from an apparatus with no cladding at all around the cores, where the different cores would contact each other and where coupling would occur. Appellants submit that one skilled in the art would read Russel as teaching away from an apparatus with some coupling between the fiber cores.

Besides, the Appellants noted that Russel teaches (for example column 6, lines 26-29) tapering the exit ends of optical fibers to a required size and shape to eliminate the subsequent need for reshaping and focusing the rectangular excimer profile and the associated energy losses that may otherwise be encountered. The Appellants noted that Au-Yeung teaches (col. 1, lines 27-28) that heated fibers can be stretched until a desired coupling ratio is achieved, but does not teach that it is possible to achieve simultaneously a desired optical coupling and a required size and shape. Accordingly, Appellants respectfully

submitted that even if one skilled in the art had, for some undisclosed reason, decided to use the fibers of Au-Yeung in Russel, and for another undisclosed reason had decided to stretch the fibers until coupling appears between the fibers, instead of simply tapering them, one skilled in the art would still have obtained between the fibers a given coupling corresponding to the required size and shape of Russel. The Appellants submitted that an apparatus having such a given coupling would not read on an apparatus *"wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber"*, as recited in claim 28.

In the Office Action issued on May 5, 2006, the Examiner opined that Au-Yeung discloses that it is well known that various amounts of stretching during the fusing process lead to various amounts of coupling between the cores of the fibers within the bundle, and opined that it would have been obvious to one of ordinary skill in the art to combine the teachings of Russel and Au-Yeung as it would allow the design process of Russel to be modified to achieve the desired amount of coupling by stretching the fused portion of the bundle by an amount denoted by Au-Yeung.

Appellants respectfully disagree. Appellants note that Au-Yeung teaches that tapering together two or more optical fibers having narrow cores such as single-mode fibers leads to a coupling between the fiber cores, and that Hill (U.S. 5,150,439, cited by the Examiner as being part of the knowledge of the skilled person) teaches that tapering together two single-mode fibers leads to a coupling between the fiber cores. Russel, as acknowledged by the Examiner, uses multimode fibers and does not disclose that there is coupling between the tapered multimode fibers. The Examiner noted that the test for obviouness is what the combined teachings of the references would have suggested to those of ordinary skill in the art.

Assuming that one skilled in the art would be interested, for an undisclosed reason, in introducing some coupling between the fibers of Russel, Appellants respectfully submit that, Au-Yeung, Hill and Russel considered together suggest that single mode fibers must be used to have fiber core

coupling. However, it has been shown above that using single mode fibers in Russel would reduce severely the power transmitted by the apparatus. The prior art, including Au-Yeung, would therefore have suggested that coupling cannot be achieved using the teachings of Au-Yeung without going against the object of Russel to reduce losses, thus making the apparatus of Russel unsatisfactory for its intended purpose. Appellants therefore respectfully submit that the combination of Russel and Au-Yeung is improper.

Besides, the Appellants note that even if one skilled in the art had actually combined the teachings of Russel and Au-Yeung, despite the fact that such combination would make the apparatus of Russel unsatisfactory for its intended purpose of reducing losses, Au-Yeung teaches that heated fibers can be stretched until a desired coupling ratio is achieved, but does not teach that it is possible to achieve simultaneously a desired optical coupling and a required size and shape. As argued previously, Russel teaches tapering the exit ends of optical fibers to a required <u>size and shape</u> to eliminate the subsequent need for reshaping and focusing the rectangular excimer profile and the associated energy losses that may otherwise be encountered. Accordingly, the combined teachings of Russel and Au-Yeung would still have had either:

-a desired amount of optical coupling between the fibers, but not the desired dimensions, and would have been unsatisfactory for the intended purpose of Russel's device (whereby combining Russel and Au-Yeung is improper); or

-the desired dimensions, but not the desired optical coupling between the fibers, and would thus not have read on the features of claim 28 and in particular *"the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber"*.

At least in view of the above, Appellants respectfully submit that claim 28 is patentable over Russel in view of Au-Yeung, whereby the Examiner's rejection should be properly overturned.

The Examiner further opined that claim 28 only requires stretching to provide desired coupling, and does not require a precise shape to be formed. The

Examiner is respectfully reminded that section 2143.01 of the MPEP provides (emphasis added) that "**If proposed modification would render <u>the prior art invention</u> being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification**". It is therefore irrelevant to note that claim 28 does not require a precise shape to be formed. Russel requires a precise dimensioning. Tapering the fibers as taught by Au-Yeung to obtain a given coupling, as required by claim 28, would have jeopardized such precise dimensioning. The combination of Russel and Au-Yeung to obtain claim 28 is therefore improper.

<u>Rejection of claim 29</u>

Claim 29 recites "*A fiber optic apparatus comprising: a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and a facet, said facet being formed by cleaving or cut and polishing said tapered region; wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber*".

Claim 29 stands objected under the same rationale as claim 28. Appellants respectfully note that Au-Yeung teaches that tapering together two or more optical fibers having narrow cores such as single-mode fibers leads to a coupling between the fiber cores; Hill teaches that tapering together two single-mode fibers leads to a coupling between the fiber cores; and Russel uses multimode fibers and does not disclose that there is coupling between the tapered multimode fibers. Accordingly, assuming that one skilled in the art would, for an undisclosed reason, introduce some coupling between the fibers of Russel, Au-Yeung, Hill and Russel considered together suggest that single-mode fibers must be used to obtain fiber core coupling. However, using single mode fibers in Russel would reduce severely the power transmitted by the apparatus and go against the object of Russel to reduce losses, thus making the apparatus of Russel

unsatisfactory for its intended purpose, whereby the prior art suggests that combining Russel and Au-Yeung would be improper.

Besides, even if one skilled in the art had actually combined the teachings of Russel and Au-Yeung, despite the fact that such combination would make the apparatus of Russel unsatisfactory for its intended purpose of reducing losses, Au-Yeung teaches that heated fibers can be stretched until a desired coupling ratio is achieved but does not teach that it is possible to achieve simultaneously a desired optical coupling and a required size and shape. On another hand, Russel teaches tapering the exit ends of optical fibers to a required <u>size and shape</u> to eliminate the subsequent need for reshaping and focusing the rectangular excimer profile and the associated energy losses that may otherwise be encountered. Accordingly, the combined teachings of Russel and Au-Yeung would still have had either:

-a desired amount of optical coupling between the fibers, but not the desired dimensions, and would have been unsatisfactory for the intended purpose of Russel's device (whereby combining Russel and Au-Yeung is improper); or

-the desired dimensions, but not the desired optical coupling between the fibers, and would thus not have read on the features of claim 28 and in particular *"the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber"*.

For this reason also, Appellants respectfully submit that claim 28 is patentable over Russel in view of Au-Yeung, whereby the Examiner's rejection should be properly overturned.

<u>Rejection of claim 30</u>

The Appellants note that claim 30, taken in its dependency of claim 29, has the same scope as claim 28. Accordingly, claim 30 is patentable over Russel and Au-Yeung for the same reasons as claim 28.

Rejection of claims 4, 5 and 10

Claims 4, 5 and 10 depend on claim 28. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claims 4, 5 and 10 are also allowable. Further, Appellants will now show that the rationale for rejecting the following claims based upon their recited features is also not proper.

Claim 4 recites "*The apparatus of claim 28, wherein each optical fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region*". In the Office Action issued on May 5, 2006, the Examiner opined that "Figure 3 of Russel clearly illustrates the core diameter of each optical fiber in the tapered region 15b is smaller than the core diameter of each optical fiber in the non-tapered region 15a". Appellants respectfully disagree. Appellants have carefully considered Figure 3 of Russel and could not determine what could be the factual basis used by the Examiner to opine that such figure "clearly illustrates the core diameter of each optical fiber in the tapered region 15b is smaller than the core diameter of each optical fiber in the non-tapered region 15a".

Appellants note in particular that the core of the fibers is not illustrated on the Figure 3 available to the Appellants. Fig. 3 of Russel is reproduced hereafter.

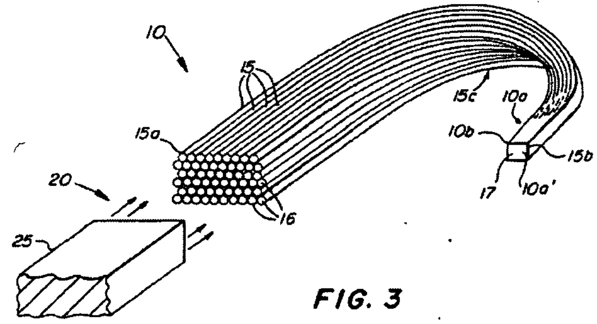


FIG. 3

For the reasons above also, Appellants respectfully submit that the Examiner has failed to show that Russel or Au-Yeung disclose or suggest the features recited in claim 4, and in particular an apparatus "*wherein each optical*

fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region", whereby claim 4 is patentable over Russel in view of Au-Yeung, and whereby the Examiner's rejection should be properly overturned.

Claim 5 recites *"The apparatus of claim 28, wherein each optical fiber is adapted to receive an optical input from a plurality of optical inputs at the second end, and wherein the plurality of optical inputs are emitted into free space at the facet as a single combined optical output"*. In the Office Action issued on May 5, 2006, the Examiner opined that "Russel also teaches each optical fiber 15 is adapted to receive input signals adjacent the second end 15' and emit the signals as a combined output at the facet adjacent the second end of the fiber 15" (column 7, lines 12-17, Figure 5)". The Appellants respectfully disagree. Column 7, lines 12-17 of Russel recites *"This FBH is configured to accommodate more than one laser 25' which each emits energy into selective groups of fibers 15' and delivers selective amounts of the emitted energy in predetermined amounts at one or more output surfaces 15'."* Appellants respectfully submit that by teaching to deliver selective amounts of energy in predetermined amounts at the output surfaces, Russel actually teaches away from emitting a plurality of optical inputs as a *"single combined optical output"*, as recited in claim 5. For this reason also, Appellants respectfully submit that the Examiner has failed to show that Russel or Au-Yeung disclose or suggest the features recited in claim 5, whereby claim 5 is patentable over Russel in view of Au-Yeung, and whereby the Examiner's rejection should be properly overturned.

Claim 10 recites *"The apparatus of claim 28, wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers"*. In the Office Action issued on May 5, 2005, the Examiner opined that "Russel teaches at least one optical fiber has a different core size from at least one other optical fiber (column 4, lines 21-25)". Appellants respectfully disagree and note that column 4, lines 21-25 of Russel recites: *"A multitude of individual optical fibers 15 can be included to an extent necessary for any practicable size and shape thereby allowing collection of light beam 20*

at input ends 15a from any excimer laser 25." Appellants note that the above excerpt teaches that a plurality of fibers can be used, and that varying the number of fibers used will allow obtaining "*any practicable size and shape*" for Russel's apparatus. However, Appellants respectfully note that the above excerpt does not seem to teach or suggest that "at least one optical fiber has a different core size from at least one other optical fiber", contrary to the Examiner's assertion.

For the reasons above also, Appellants respectfully submit that the Examiner has failed to show that Russel or Au-Yeung disclose or suggest the features recited in claim 10, and in particular an apparatus wherein "*at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers*", whereby claim 10 is patentable over Russel in view of Au-Yeung, and whereby the Examiner's rejection should be properly overturned.

Rejection of claim 11

Claim 11 recites "*A method for coupling light comprising:*

providing a plurality of optical fibers, each optical fiber having a first end, a second end, and a central core extending between the first and second end;

fusing the optical fibers together along a section of each optical fiber proximate the first end to form a fused section;

tapering the fused section of the optical fibers such that a core diameter of each optical fiber proximate the first end is smaller than the core diameter proximate the second end, wherein tapering the fused section comprises uniformly stretching the plurality of optical fibers to provide a desired amount of optical coupling between each optical fiber;

forming a facet by cleaving or cutting and polishing said fused section in a direction perpendicular to the core; and

illuminating the facet with the light".

In the response to arguments of the Office Action issued on May 5, 2006, the Examiner opined that claim 11 is not patentable over Russel in view of Au-Yeung for the reasons cited in relation with claim 28.

Appellants respectfully disagree and note that, as detailed above in relation with claim 28, Au-Yeung teaches that tapering together two or more optical fibers having narrow cores such as single-mode fibers leads to a coupling between the fiber cores, and Hill teaches that tapering together two single-mode fibers leads to a coupling between the fiber cores. Russel uses multimode fibers and does not disclose that there is coupling between the tapered multimode fibers. The Examiner noted that the test for obviouness is what the combined teachings of the references would have suggested to those of ordinary skill in the art. Assuming that one skilled in the art would be interested, for an undisclosed reason, in introducing some coupling between the fibers of Russel, Appellants respectfully submit that, Au-Yeung, Hill and Russel considered together suggest that single-mode fibers must be used to obtain fiber core coupling. However, using single mode fibers in Russel would reduce severely the power transmitted by the apparatus and go against the object of Russel to reduce losses, thus making the apparatus of Russel unsatisfactory for its intended purpose. Therefore, the combination of Russel and Au-Yeung is improper.

Besides, even if one skilled in the art had actually combined the teachings of Russel and Au-Yeung, despite the fact that such combination would make the apparatus of Russel unsatisfactory for its intended purpose of reducing losses, Au-Yeung teaches that heated fibers can be stretched until a desired coupling ratio is achieved, but does not teach that it is possible to achieve simultaneously a desired optical coupling and a required size and shape. Russel teaches tapering the exit ends of optical fibers to a required <u>size and shape</u> to eliminate the subsequent need for reshaping and focusing the rectangular excimer profile and the associated energy losses that may otherwise be encountered. Accordingly, the combined teachings of Russel and Au-Yeung would still have had led to:

-a desired amount of optical coupling between the fibers, but not the desired dimensions, and would have been unsatisfactory for the intended purpose of Russel's device (whereby combining Russel and Au-Yeung is improper); or

-the desired dimensions, but not the desired optical coupling between the fibers, and would thus not have read on a method as in claim 11 and in particular

comprising *"tapering the fused section of the optical fibers [...] wherein tapering the fused section comprises uniformly stretching the plurality of optical fibers to provide a desired amount of optical coupling between each optical fiber"*.

At least in view of the above, Appellants respectfully submit that claim 11 is patentable over Russel in view of Au-Yeung, whereby the Examiner's rejection should be properly overturned.

Rejection of claims 14 and 19

Claims 14 and 19 depend on claim 11. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claims 14 and 19 are also allowable. Further, Appellants will now show that the rationale for rejecting the following claims based upon their recited features is also not proper.

Claim 14 recites *"The method of claim 11, wherein the step of illuminating further comprises the steps of:*

providing an optical input at the second end of each optical fiber; and

emitting the optical inputs as a single combined optical output at the facet into free space".

In the Office Action issued on May 5, 2006, the Examiner opined that "Russel also teaches each optical fiber 15 is adapted to receive input signals adjacent the second end 15' and emit the signals as a combined output at the facet adjacent the second end of the fiber 15" (column 7, lines 12-17, Figure 5)".

The Appellants respectfully disagree. Column 7, lines 12-17 of Russel recites *"This FBH is configured to accommodate more than one laser 25' which each emits energy into selective groups of fibers 15' and delivers selective amounts of the emitted energy in predetermined amounts at one or more output surfaces 15'."* Appellants respectfully submit that by teaching to deliver selective amounts of energy in predetermined amounts at the output surfaces, Russel actually teaches

away from emitting a plurality of optical inputs as a *"single combined optical output"*, as recited in claim 14. For this reason also, Appellants respectfully submit that the Examiner has failed to show that Russel or Au-Yeung disclose or suggest the features recited in claim 14, whereby claim 14 is patentable over Russel in view of Au-Yeung, and whereby the Examiner's rejection should be properly overturned.

Claim 19 recites *"The method of claim 11, wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers"*. In the Office Action issued on May 5, 2005, the Examiner opined that "Russel teaches at least one optical fiber has a different core size from at least one other optical fiber (column 4, lines 21-25)". Appellants respectfully disagree and note that column 4, lines 21-25 of Russel recites: *"A multitude of individual optical fibers 15 can be included to an extent necessary for any practicable size and shape thereby allowing collection of light beam 20 at input ends 15a from any excimer laser 25."* Appellants note that the above excerpt teaches that a plurality of fibers can be used, and that varying the number of fibers used will allow obtaining *"any practicable size and shape"* for Russel's apparatus. Appellants respectfully note that the above excerpt does not seem to teach or suggest that *"at least one optical fiber has a different core size from at least one other optical fiber"* as recited in claim 19, contrary to the Examiner's assertion.

For the reasons above also, Appellants respectfully submit that the Examiner has failed to show that Russel or Au-Yeung disclose or suggest the features recited in claim 19, and in particular an apparatus wherein *"at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers"*, whereby claim 19 is patentable over Russel in view of Au-Yeung, and whereby the Examiner's rejection should be properly overturned.

Rejection of claim 9

Claim 9 depends on claim 1. "If an independent claim is nonobvious

under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claim 9 is also allowable. Further, Appellants will now show that the rationale for rejecting claim 9 based upon its recited features is also not proper.

Claim 9 recites "*The apparatus of claim 1, wherein the plurality of optical fibers disposed in the fused section are uniformly stretched to provide a desired amount of optical coupling between each optical fiber*". In the response to arguments of the Office Action issued on May 5, 2006, the Examiner opined that claim 9 is not patentable over Russel in view of Au-Yeung for the reasons cited in relation with claim 28.

Appellants respectfully disagree and note that, as detailed above in relation with claim 28, Au-Yeung teaches that tapering together two or more optical fibers having narrow cores such as single-mode fibers leads to a coupling between the fiber cores, and Hill teaches that tapering together two single-mode fibers leads to a coupling between the fiber cores. Russel uses multimode fibers and does not disclose that there is coupling between the tapered multimode fibers. The Examiner noted that the test for obviouness is what the combined teachings of the references would have suggested to those of ordinary skill in the art. Assuming that one skilled in the art would be interested, for an undisclosed reason, in introducing some coupling between the fibers of Russel, Appellants respectfully submit that, Au-Yeung, Hill and Russel considered together suggest that single-mode fibers must be used to obtain fiber core coupling. However, using single mode fibers in Russel would reduce severely the power transmitted by the apparatus and go against the object of Russel to reduce losses, thus making the apparatus of Russel unsatisfactory for its intended purpose. Therefore, the prior art suggests that the combination of Russel and Au-Yeung is improper.

Besides, even if one skilled in the art had actually combined the teachings of Russel and Au-Yeung, despite the fact that such combination would make the apparatus of Russel unsatisfactory for its intended purpose of reducing losses,

Au-Yeung teaches that heated fibers can be stretched until a desired coupling ratio is achieved, but does not teach that it is possible to achieve simultaneously a desired optical coupling and a required size and shape. Russel teaches tapering the exit ends of optical fibers to a required size and shape to eliminate the subsequent need for reshaping and focusing the rectangular excimer profile and the associated energy losses that may otherwise be encountered. Accordingly, the combined teachings of Russel and Au-Yeung would still have had led to:

-a desired amount of optical coupling between the fibers, but not the desired dimensions, and would have been unsatisfactory for the intended purpose of Russel's device (whereby combining Russel and Au-Yeung is improper); or

-the desired dimensions, but not the desired optical coupling between the fibers, and would thus not have read on an apparatus as recited in claim 9 and in particular *"wherein the plurality of optical fibers disposed in the fused section are uniformly stretched to provide a desired amount of optical coupling between each optical fiber"*.

At least in view of the above, Appellants respectfully submit that claim 9 is patentable over Russel in view of Au-Yeung, whereby the Examiner's rejection should be properly overturned.

Issue 9: Whether claims 2 and 13 are patentable under 35 U.S.C. 103(a) over Russel in view of Au-Yeung and further in view of Basavanhally.

Rejection of claim 2

Claim 2 depends on claim 28. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claim 2 is also allowable. Further, Appellants will now show that the rationale for rejecting claim 2 based upon its recited features is also not proper.

Claim 2 recites: *"The apparatus of claim 28, wherein the plurality of optical fibers are arranged in an array, the array being selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays"*. In the Office Action issued on May 5, 2006, the Examiner opined that "the use of the teachings of Bassavanhally with the device described above by Russel would have been obvious to a person of ordinary skill in the art, as the hexagonal array described by Basavanhally minimizes unused space within the optical bundle". Appellants respectfully disagree and note that Basavanhally relates to a precise fiber array formed by employing a precise array of ferrules arranged with a hexagonal packing structure, the ends of optical fibers being bonded into the ferrules (column 2, lines 12-15), wherein there is plenty of unused space between the ferrules (see for example Fig. 8 of Basavanhally, reproduced below) and even more unused space between the fibers, the ends of which are not contacting each other (see Fig. 9 of Basavanhally, reproduced below).

FIG. 8

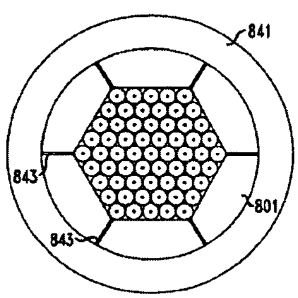
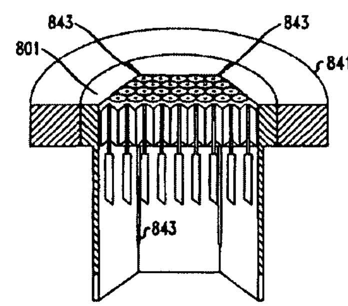


FIG. 9



Appellants respectfully note that the Examiner has failed to show why the structure of Basavanhally, wherein the fibers ends do not even contact each other, could teach any way to "minimizes unused space" in the "closely packed" fiber bundle of Russel.

The Examiner opined that "certainly the overall teaching supplied by Basavanhally shows the formation of arrays showing a hexagonal shape, and while the actual scaled device of Russel may not couple with the actual scalled array of Basavanhally, the teachings remain applicable, namely because they show that it is possible to use arrays of various geometries for optical fiber bundles". Appellants respectfully disagree, and note that contrary to the

Examiner's assertion, Basavanhally does not "show that it is possible" to use an array of fibers showing an hexagonal shape: Basavanhally only shows that, if one wants a fiber bundle ending with an hexagonal shape, one has to insert the ends of the fibers in ferrules and assemble the ferrules in the hexagonal shape. Such assembly causes considerable loss of space, whereby applying the teachings of Basavanhally to the apparatus of Russel would prevent from "closely packing" the fibers of Russel, and would lead to a device collecting only a reduced amount of light (much light would be reflected by the ferrules) and therefore having important power losses. Appellants note that a device applying the teachings of Basavanhally to the apparatus of Russel would be unsatisfactory for the intended purpose of Russel, which is "to provide an optical homogenization having reduced losses". Accordingly, Appellants submit that the combination of Russel and Basavanhally is improper, whereby the Examiner has failed to show that claim 2 would have been obvious over Russel and Basavanhally, and the Examiner's rejection should be properly overturned.

Rejection of claim 13

Claim 13 depends on claim 11. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claim 13 is also allowable. Further, Appellants will now show that the rationale for rejecting claim 13 based upon its recited features is also not proper.

Claim 13 recites "*The method of claim 11, wherein the array is selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays*". In the Office Action issued on May 5, 2006, the Examiner opined that "the use of the teachings of Bassavanhally with the device described above by Russel would have been obvious to a person of ordinary skill in the art, as the hexagonal array described by Basavanhally minimizes unused space within the optical bundle". As in the case of claim 2 above, Appellants respectfully disagree and note that Basavanhally relates to a structure wherein there is plenty of unused space between the fibers, the ends of

which are not contacting each other (see Fig. 9 of Basavanhally, reproduced above). Appellants respectfully note that the Examiner has failed to show why such structure would teach a way to "minimizes unused space" in the "closely packed" bundle of Russel.

Appellants further submit that Basavanhally shows that if one wants a fiber bundle having an end with an hexagonal shape, one has to insert the ends of the fibers in ferrules and assemble the ferrules in the hexagonal shape. Such assembly causes considerable loss of space, whereby applying the teachings of Basavanhally to the apparatus of Russel would prevent from "closely packing" the fibers of Russel, and would make Russel unsatisfactory for its intended purpose, which is "to provide an optical homogenization having reduced losses". Accordingly, Appellants submit that the combination of Russel and Basavanhally is therefore improper, whereby the Examiner has failed to show that claim 13 would have been obvious over Russel and Basavanhally, and the Examiner's rejection should be properly overturned.

Issue 10: Whether claims 3 and 12 are patentable under 35 U.S.C. 103(a) over Russel in view of Au-Yeung and further in view of Smith.

Claim 3 depends on claim 28 and claim 12 depends on claim 11. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claims 3 and 12 are also allowable.

Issue 11: Whether claims 7 and 16 are patentable under 35 U.S.C. 103(a) over Russel in view of Au-Yeung and further in view of Smith and Anthon.

Rejection of claim 7

Claim 7 depends indirectly on claim 28. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claim 7 is also allowable. Further, Appellants will now show that the rationale for rejecting claim 7 based upon its recited features is also not proper.

Claim 7 recites: *"The apparatus of claim 3, wherein the glass matrix is comprised of fluorosilicate"*. In the Office Action issued on May 5, 2006, the Examiner acknowledged that neither Russel, nor Au-Yeung nor Smith discloses the use of a fluorosilicate glass matrix in the formation of optical fiber bundles. However, the Examiner opined that Anthon discloses the use of fluorosilicate glass matrix in the formation of optical fiber bundles (column 13, lines 1-16, figure A). Appellants respectfully disagree and note that column 13, lines 1-16 of Anthon recite *"FIGS. 4A-4D illustrate a similar fabrication technique that can be used to introduce irregularities into the shape of a preform 65. According to this technique, a standard multimode preform 65, comprising, e.g., **an** undoped fused silica inner region 68 and a fluorine doped outer layer 70, is obtained. An ultrasonic drill is used to drill equally spaced holes 72-84 immediately inside the boundary between inner region 68 and layer 70. By way of example, eight holes, each having a diameter of about 10% of the preform diameter, can be drilled on circle at about 60% of the preform diameter, leaving a small amount of silica material between the holes and the boundary between region 68 and layer 70 to protect the fluorosilicate glass of the outer layer 70. Preferably, the distance between each hole and the boundary between cladding layers 68, 70 is approximately 1-2% of the preform diameter"*.

Appellants respectfully submit that the above excerpt relates to the manufacturing of one particular fiber, not of an optical fiber bundle, contrary to the assertion of the Examiner. Accordingly, the Examiner has failed to show that there would have been any motivation for one skilled in the art to use the

teachings of Anthon in the formation of optical fiber bundles. In view of the above, Appellants respectfully submit that the Examiner has failed to show that it would have been obvious for one skilled in the art to combine the teachings of Russel, Au-Yeung, Smith and Anthon to obtain an apparatus as recited in claim claim 7, whereby claim 7 is patentable over Russel, Au-Yeung, Smith and Anthon, and the Examiner's rejection should be properly overturned.

Rejection of claim 16

Claim 16 depends indirectly on claim 11. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claim 16 is also allowable. Further, Appellants will now show that the rationale for rejecting claim 16 based upon its recited features is also not proper.

Claim 16 recites: "*The method of claim 12, wherein the glass matrix comprises fluorosilicate*". In the Office Action issued on May 5, 2006, claim 16 was rejected under the same rationale as claim 7. As detailed above in relation with claim 7, Appellants note that the Examiner acknowledged that neither Russel, nor Au-Yeung nor Smith discloses the use of a fluorosilicate glass matrix in the formation of optical fiber bundles, and that Anthon does not relate to the manufacturing of an optical fiber bundle, contrary to the assertion of the Examiner. Accordingly, Appellants respectfully submit that the Examiner has failed to show that there would have been any motivation for one skilled in the art to use the teachings of Anthon in the formation of optical fiber bundles, whereby the Examiner has failed to show that it would have been obvious for one skilled in the art to combine the teachings of Russel, Au-Yeung, Smith and Anthon to obtain an apparatus as recited in claim claim 7, whereby claim 7 is patentable over Russel, Au-Yeung, Smith and Anthon, and whereby the Examiner's rejection should be properly overturned.

Issue 12: Whether claims 6, 8, 15 and 17 are patentable under 35 U.S.C. 103(a) over Russel in view of Au-Yeung and further in view of Harootian.

Claims 6 and 8 depend directly or indirectly on claim 28, and claims 15 and 17 depend directly or indirectly on claim 11. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Therefore, at least in light of the above discussion, Appellants submit that claims 6, 8, 15 and 17 are also allowable. Further, Appellants will now show that the rationale for rejecting the following claims based upon their recited features is also not proper.

Claim 8 recites "*The apparatus of claim 6, wherein the optical input has a diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber*".

Claim 17 recites "*The method of claim 15, wherein the optical input has diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber*".

In the Office Action issued on May 5, 2006, the Examiner opined that Russel "specifically states that the device may be fashioned into a number of size and shapes, and would include the arrangement where the optical input at the unfused end of the optical fiber is larger than the diameter of the same optical input at the fused end of the given optical fiber (column 5, lines 8-16, Figure 3)". Appellants respectfully disagree and note that column 5, lines 8-16 of Russel recite "*Tapering of fibers 15 of FBH 10 in fused region 10a while the fibers are plastic during fusing is an option that may be used to give a further capability since this technique further allows region 10a of the FBH to be fashioned into the different sizes and shapes required for a subsequent materials processing operation*", and does not disclose or suggest that the tapering of the fibers modifies the optical input of each fiber. Besides, Appellants have carefully considered Figure 3 of Russel and could not determine what could be the factual basis used by the Examiner to opine that

such figure discloses or suggests that the tapering of the fibers modifies the optical input of each fiber. Accordingly, Appellants respectfully submit that the Examiner has failed to show that any of Russel, Au-Yeung or Harootian disclose or suggest the features recited in claims 8 or 17, and in particular *"wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber"*, whereby claims 8 and 17 are patentable over Russel in view of Au-Yeung and Harootian, and whereby the Examiner's rejection should be properly overturned.

CONCLUSION

For the extensive reasons advanced above, Appellants respectfully contend that each claim is patentable. Therefore, reversal of the above-addressed rejections and objections and re-opening of the prosecution is respectfully solicited.

The Commissioner is authorized to charge any additional fees that may be required or credit overpayment to deposit account no. 12-0415. In particular, if this response is not timely filed, the Commissioner is authorized to treat this response as including a petition to extend the time period pursuant to 37 CFR 1.136(a) requesting an extension of time of the number of months necessary to make this response timely filed and the petition fee due in connection therewith may be charged to deposit account no. 12-0415.

I hereby certify that this correspondence is being deposited with the United States Post Office with sufficient postage as first class mail in an envelope addressed to: Mail Stop Appeal Brief-Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on November 3, 2006 (Date of Transmission) Susan Papp (Name of Person Transmitting) Susan Papp (Signature) 11/3/06 (Date)	Respectfully submitted, Richard P. Berg Attorney for the Applicant Reg. No. 28,145 LADAS & PARRY 5670 Wilshire Boulevard, Suite 2100 Los Angeles, California 90036 (323) 934-2300 voice (323) 934-0202 facsimile

Attachments: Claims 1-17 and 19-30

CLAIMS APPENDIX

1. A fiber optic apparatus comprising:

a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region, wherein the second end of the fibers are detached from each other; and

a facet, said facet being formed by cleaving or cut and polishing said tapered region in a direction perpendicular to said fiber axis.

2. The apparatus of claim 28, wherein the plurality of optical fibers are arranged in an array, the array being selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays.

3. The apparatus of claim 28, wherein the plurality of optical fibers is provided in a glass matrix.

4. The apparatus of claim 28, wherein each optical fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region.

5. The apparatus of claim 28, wherein each optical fiber is adapted to receive an optical input from a plurality of optical inputs at the second end, and wherein the plurality of optical inputs are emitted into free space at the facet as a single combined optical output.

6. The apparatus of claim 28, wherein the facet is adapted to receive a

single optical input traveling in free space, the single optical input being distributed amongst each optical fiber in the plurality of optical fibers.

7. The apparatus of claim 3, wherein the glass matrix is comprised of fluorosilicate.

8. The apparatus of claim 6, wherein the optical input has a diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber.

9. The apparatus of claim 1, wherein the plurality of optical fibers disposed in the fused section are uniformly stretched to provide a desired amount of optical coupling between each optical fiber.

10. The apparatus of claim 28, wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers.

11. A method for coupling light comprising:

providing a plurality of optical fibers, each optical fiber having a first end, a second end, and a central core extending between the first and second end;

fusing the optical fibers together along a section of each optical fiber proximate the first end to form a fused section;

tapering the fused section of the optical fibers such that a core diameter of each optical fiber proximate the first end is smaller than the core diameter proximate the second end, wherein tapering the fused section comprises uniformly stretching the plurality of optical fibers to provide a desired amount of optical coupling between each optical fiber;

forming a facet by cleaving or cutting and polishing said fused section in a direction perpendicular to the core; and

illuminating the facet with the light.

12. The method of claim 11, further comprising the steps of:

arranging the plurality of optical fibers in an array; and

disposing the plurality of optical fibers in a glass matrix.

13. The method of claim 11, wherein the array is selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays.

14. The method of claim 11, wherein the step of illuminating further comprises the steps of:

providing an optical input at the second end of each optical fiber; and

emitting the optical inputs as a single combined optical output at the facet into free space.

15. The method of claim 11, wherein the step of illuminating further comprises the steps of:

illuminating the facet with a single optical input traveling in free space; and

distributing the single optical input amongst each optical fiber in the plurality of optical fibers to provide a plurality of distributed optical outputs.

16. The method of claim 12, wherein the glass matrix comprises fluorosilicate.

17. The method of claim 15, wherein the optical input has diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber.

18. (canceled)

19. The method of claim 11, wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers.

20. An apparatus for coupling light comprising:

a plurality of single mode optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and

a facet, said facet being formed by cleaving or cutting and polishing the tapered region in a direction perpendicular to said fiber axis, wherein the facet is adapted to receive a single optical input, the single optical input being distributed amongst each optical fiber in the plurality of optical fibers, wherein the optical input has a diameter, and wherein the diameter of the optical input at the first end of a given optical fiber is larger than the diameter of the same optical input at the second end of the given optical fiber.

21. The apparatus of claim 20, wherein the plurality of optical fibers are arranged in an array, the array being selected from a member of the group consisting of hexagonal close packed arrays, square close packed arrays, and three-nearest neighbor packed arrays.

22. The apparatus of claim 20, wherein the plurality of optical fibers are provided in a glass matrix.

23. The apparatus of claim 20, wherein each optical fiber has a core diameter, the core diameter of each optical fiber in the tapered region being smaller than the core diameter of each optical fiber in a non-tapered region.

24. The apparatus of claim 22, wherein the glass matrix is comprised of fluorosilicate.

25. The apparatus of claim 20, where the plurality of optical fibers in the fused section are uniformly stretched to provide a desired amount of optical coupling between each optical fiber.

26. The apparatus of claim 20, wherein at least one optical fiber of the plurality of optical fibers has a different core size and/or refractive index from at least one other optical fiber of the plurality of optical fibers.

27. A fiber optic apparatus comprising:

a plurality of single mode silica optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and

a facet, said facet being formed by cleaving or cut and polishing said tapered region in a direction perpendicular to said fiber axis.

28. A fiber optic apparatus comprising:

a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and

a facet, said facet being formed by cleaving or cut and polishing said tapered region in a direction perpendicular to said fiber axis;

wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber.

29. A fiber optic apparatus comprising:

a plurality of optical fibers, each optical fiber having a first end and a second end, said plurality of fibers being fused together along a section of each optical fiber proximate the first end of each optical fiber to form a fused section having a fiber axis, the fused section of the plurality of optical fibers being tapered to form a tapered region; and

a facet, said facet being formed by cleaving or cut and polishing said tapered region;

wherein the plurality of optical fibers disposed in the fused section are stretched to provide a desired amount of optical coupling between each optical fiber.

30. The fiber optic apparatus of claim 29, wherein said facet has a direction perpendicular to said fiber axis.

EVIDENCE APPENDIX

There is no evidence submitted with the present Appeal Brief.

RELATED PROCEEDINGS APPENDIX

There are no other appeals or interferences related to the present application.